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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/649,697	08/28/2003	Satoru Ohishi	242158US3S	6746

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EXAMINER	
BROOME, SAID A	

ART UNIT	PAPER NUMBER
2628	

DATE MAILED: 05/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/649,697	OHISHI, SATORU	
	Examiner	Art Unit	
	Said Broome	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 February 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This office action is in response to an amendment filed 2/21/2006.

2. Claims 1, 6, 11, 12, 15 and 16 have been amended by the applicant.

3. Claims 2-5, 7-10, 13, 14 and 17-20 are original.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Negrelli et al. (US Patent 5,712,895) in view of Strobel (US Patent 6,650,724).

Regarding claims 1 and 11, Negrelli et al. teaches what is disclosed except for the reconstruction unit that reconstructs the volume data of mask and subtraction images, the image processing unit that generates a 3D image of bone and/or soft tissue and one of a blood vessel, and an image synthesizing unit that synthesizes the two images. Negrelli et al. describes a storing unit that stores mask and contrast images corresponding to projection directions related to the object, which is illustrated in Figure 1 as element 42 and 70, and is described in column 2 lines 23-28, column 4 line 62 and column 5 lines 33-35. Negrelli et al. provides a description of a memory that stores the projection directions that relate to the image taken during rotations

around the object. It is also described by Negrelli et al. that the forward images refer to the mask images, and the reverse image refer to the contrast images, in column 8 lines 5-7. Negrelli et al. also teaches a subtracting unit that generates subtraction image data by subtracting mask images from contrast images in column 2 lines 55-60 and is illustrated in element 86 of Figure 1. Though it is not explicitly taught that mask data is generated by subtracting the subtraction data from the contrast data, it would have been obvious to one of ordinary skill in the art to perform this subtraction by substituting the subtraction image for the mask image and perform the same subtraction from the contrast data because all the data for the contrast, mask and subtraction images are all generated as taught by Negrelli et al.(column 2 lines 55-60 and is illustrated in element 86 of Figure 1), and it would have been obvious for one of ordinary skill in the art to provide any two particular sets of these data to be subtracted to generate data of interest, including mask data. Negrelli et al. also teaches a display unit that displays the synthetic image in column 8 lines 5-7 and is illustrated as element 88 of Figure 1. Again, Negrelli et al. fails to teach the reconstruction unit that reconstructs the volume data of mask and subtraction images, the image processing unit that generates a 3D image of bone and/or soft tissue and one of a blood vessel, and the image synthesizing unit that synthesizes the two images. Strobel describes a reconstruction of a first set of volume data produced from mask images and a second set of volume data produced from fill images, or images with contrast agent also called contrast images, in column 1 lines 54-55. Strobel describes this reconstruction to be executed by means of a C-arm apparatus, in column 1 lines 12-16, which must contain a reconstruction unit to enable this 3D volume reconstruction. Strobel also describes generating one 3D image of a bone structure from the volume data of the mask image, and another 3D image of a blood vessel

from the volume data of the contrast image in column 1 lines 12-16 and 52-55. It is known to one of ordinary skill in the art that mask images contain images of bone structure and/or tissues with the absence of a contrast agent, which is described by Strobel in column 1 lines 19-20. It is also known to one of ordinary skill in the art that contrast images contain images of blood vessels and are described by Strobel in column 1 lines 56-57. A synthetic image is generated by synthesizing the two 3D images and is described by Strobel in column 2 lines 31-40, which is illustrated in Figure 2. As previously stated, the generation of the 3D images are processed using a C-arm apparatus that comprises an image processing unit for image processing, and an image synthesizing unit for image synthesizing which is referenced by Strobel in column 1 lines 12-16 and is known in the art. Therefore it would have been obvious to one of ordinary skill in the art to combine the storing capability of several mask and contrast images, the generation of subtraction images by subtracting mask images from contrast images and combine it with a reconstruction unit that reconstructs 3D volume data of the mask and contrast images as taught by Strobel to produce two 3D images, one of which representing bone and/or tissue and the other displaying blood vessels in Negrelli et al.'s system. Motivation for this combination would produce a 3D digital subtraction image processing apparatus that improves the resolution and clarity of mask and contrast images by producing synthesized 3D images that provide a more realistic view of blood vessels for analysis.

Claims 6 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Negrelli et al. (US Patent 5,712,895) in view of Strobel (US Patent 6,650,724) in further view of Ohishi (US Patent 6,845,142).

Regarding claims 6 and 16, Negrelli et al. teaches what is disclosed except for the reconstruction unit that reconstructs the volume data of mask and subtraction images, the image processing unit that generates a 3D image of bone and/or soft tissue and one of a blood vessel, an image synthesizing unit that synthesizes the two images and a calibration unit configured to calibrate the plurality of mask images and the plurality of contrast images by using vertically and horizontally arranged lines forming a lattice as a calibration image. Negrelli et al. describes a storing unit that stores mask and contrast images corresponding to projection directions related to the object, which is illustrated in Figure 1 as element 42 and 70, and is described in column 2 lines 23-28, column 4 line 62 and column 5 lines 33-35. Negrelli et al. provides a description of a memory that stores the projection directions that relate to the image taken during rotations around the object. It is also described by Negrelli et al. that the forward images refer to the mask images, and the reverse image refer to the contrast images, in column 8 lines 5-7. Negrelli et al. also teaches a subtracting unit that generates subtraction image data by subtracting mask images from contrast images in column 2 lines 55-60 and is illustrated in element 86 of Figure 1. A display unit that displays the synthetic image is also explained by Negrelli et al. in column 8 lines 5-7 and is illustrated as element 88 of Figure 1. Again, Negrelli et al. fails to teach the reconstruction unit that reconstructs the volume data of mask and subtraction images, the image processing unit that generates a 3D image of bone and/or soft tissue and one of a blood vessel, and the image synthesizing unit that synthesizes the two images. Strobel describes a reconstruction of a first set of volume data produced from mask images and a second set of volume data produced from fill images, or images with contrast agent also called contrast images, in column 1 lines 54-55. Strobel describes this reconstruction

to be executed by means of a C-arm apparatus, in column 1 lines 12-16, which must contain a reconstruction unit to enable this 3D volume reconstruction. Strobel also describes generating one 3D image of a bone structure from the volume data of the mask image, and another 3D image of a blood vessel from the volume data of the contrast image in column 1 lines 12-16 and 52-55. It is known to one of ordinary skill in the art that mask images contain images of bone structure and/or tissues with the absence of a contrast agent, which is described by Strobel in column 1 lines 19-20. It is also known to one of ordinary skill in the art that contrast images contain images of blood vessels and are described by Strobel in column 1 lines 56-57. A synthetic image is generated by synthesizing the two 3D images and is described by Strobel in column 2 lines 31-40, which is illustrated in Figure 2. As previously stated, the generation of the 3D images are processed using a C-arm apparatus that comprises an image processing unit for image processing, and an image synthesizing unit for image synthesizing which is referenced by Strobel in column 1 lines 12-16 and is known in the art. Negrelli et al. and Strobel fail to teach a calibration unit configured to calibrate the plurality of mask images and the plurality of contrast images by using vertically and horizontally arranged lines forming a lattice as a calibration image. Ohishi teaches a calibration unit configured to calibrate the plurality of mask images and the plurality of contrast images by using vertically and horizontally arranged lines forming a lattice as a calibration image in column 11 lines 35-42 ("...the referencing projection image data is looked up to compute the grid points Q1 (grid-point information) at each of which wires intersect to each other. The 3D reconstructing processor 33 then corrects the grid points Q1 (refer to FIG. 5B) so as to be equal in intervals like the grid points Q2 (refer to FIG. 5A) (i.e., correction of the grid points)., and is also

illustrated in Figure 2 as element 33"), where it is described that projection image data, which is acquired mask or contrast projection images as described in column 7 lines 58-65("After storing such projection data into the storages 22 and 23, the processing of subtractor 31 is activated so as to perform subtraction (DSA: Digital Subtraction Angiography) processing...the subtraction is carried out for every the same imaging angle, between an image (mask image) acquired before the injection of a contrast argent and an image (contrasted image) acquired after the injection thereof."), is described to be calibrated or corrected using vertical and horizontal lines that form a lattice as illustrated in Figures 5A and 5B. Therefore it would have been obvious to one of ordinary skill in the art to combine the storing capability of several mask and contrast images, the generation of subtraction images by subtracting mask images from contrast images, combine it with a reconstruction unit that reconstructs 3D volume data of the mask and contrast images as taught by Strobel to produce two 3D images, one of which representing bone and/or tissue and the other displaying blood vessels in Negrelli et al.'s system and provide a calibration unit as taught by Ohishi. Motivation for this combination would produce a 3D digital subtraction image processing apparatus that improves the resolution and clarity of mask and contrast images by producing calibrated synthesized 3D images that provide a more realistic view of blood vessels for analysis.

Claims 2-5 and 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Negrelli et al. in view of Strobel in further view of Vining (US Patent 5,782,762).

Negrelli et al. in view of Strobel teaches what is disclosed in claims 2-5 and 12-15 except for the generation of color 3D images which have independent colors as recited in claims 2, 3, 12

and 13, the processing of the image using a volume rendering process as recited in claims 4 and 14 and the ability of the user to select whether the mask, contrast or synthetic image is displayed as recited in claims 5 and 15. Regarding claims 2 and 12, Vining describes generating a synthetic image in which the images are shown with different colors in column 20 lines 37-39. Regarding claims 3 and 13, it is also described by Vining that the images are given colors independent of each other in column 3 lines 42-44. Regarding claims 4 and 14, Vining describes generating the data of the images using a volume rendering process in column 13 lines 16-34, and shows that the 3D images are generated using a volume rendering technique that is known to one of ordinary skill in the art. Regarding claims 5 and 15, Vining also describes the ability of the user to select a mask, contrast or synthetic image in column 3 lines 24-31. Individual 3D images are captured as described in column 18 lines 59-60, and the user is provided with the option to select several views of those 3D images, which would also allow the user to select one particular image of interest. Therefore it would have obvious to one of ordinary skill in the art to combine the teachings of Vining including the display of a synthetic image which contains independent colors for each 3D image that comprises it, the generation of image data using volume rendering and the enablement of the display of certain 3D images by the user in the combined system disclosed by Negrelli et al. and Strobel. Motivation for this combination would produce a 3D digital subtraction image processing apparatus that improves resolution and clarity of calibrated mask and contrast images by producing synthesized 3D images in color that provide a more realistic observation of blood vessels for analysis.

Claims 7-10 and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Negrelli et al. in view of Strobel in further view of Ohishi, and in further view of Vining (US Patent 5,782,762).

Negrelli et al., Strobel and Ohishi teach what is disclosed in claims 7-10 and 17-20 except for the generation of color 3D images which have independent colors as recited in claims 7, 8, 17 and 18, the processing of the image using a volume rendering process as recited in claims 9 and 19 and the ability of the user to select whether the mask, contrast or synthetic image is displayed as recited in claims 10 and 20. Regarding claims 7 and 17, Vining describes generating a synthetic image in which the images are shown with different colors in column 20 lines 37-39. Regarding claim 8 and 18, it is also described by Vining that the images are given colors independent of each other in column 3 lines 42-44. Regarding claim 9 and 19, Vining describes generating the data of the images using a volume rendering process in column 13 lines 16-34, and shows that the 3D images are generated using a volume rendering technique that is known to one of ordinary skill in the art. Regarding claims 10 and 20, Vining also describes the ability of the user to select a mask, contrast or synthetic image in column 3 lines 24-31. Individual 3D images are captured as described in column 18 lines 59-60, and the user is provided with the option to select several views of those 3D images, which would also allow the user to select one particular image of interest. Therefore it would have obvious to one of ordinary skill in the art to combine the teachings of Vining including the display of a synthetic image which contains independent colors for each 3D image that comprises it, the generation of image data using volume rendering and the enablement of the display of certain 3D images by the user in the combined system disclosed by Negrelli et al., Strobel and Ohishi. Motivation for

this combination would produce a 3D digital subtraction image processing apparatus that improves resolution and clarity of calibrated mask and contrast images by producing synthesized 3D images in color that provide a more realistic observation of blood vessels for analysis.

Response to Arguments

Applicant's arguments filed 2/21/2006 have been fully considered but they are not persuasive.

The applicant argues that the references Negrelli et al. in view of Strobel and in further view of Ohishi used in the 35 U.S.C. 103(a) rejection of claims 1, 6, 11 and 16 due to the amendments to the claims, do not teach a second subtracting unit configured to generate mask volume data by subtracting the second volume data from the first volume data. The examiner maintains the rejection because Negrelli et al. teaches capturing mask images in column 2 lines 23-28 and column 4 line 62, and also teaches a subtracting unit that subtracts mask images from contrast images in column 2 lines 55-60 and is illustrated in element 86 of Figure 1. Though it is not explicitly taught that the mask data is generated by subtracting the subtraction data from the contrast data, it would have been obvious to one of ordinary skill in the art to perform this subtraction by substituting the subtraction image for the mask image and perform the same subtraction from the contrast data because all the data for the contrast, mask and subtraction images are all generated as taught by Negrelli et al., and it would have been obvious for one of ordinary skill in the art to provide any two particular sets of these data to be subtracted to generate data of interest, including mask data. Therefore in view of Strobel which teaches

generating mask and contrast volume data in column 2 lines 24-25 ("...the volume datasets V.sub.1 and V.sub.2 are generated from the 2D mask images...") and subtraction volume data in column 2 line 34 ("...the resulting difference volume ΔV."), it would have been obvious to generate mask volume data by subtracting the contrast and subtraction volume data taught by Strobel using the subtraction unit as taught by Negrelli et al. because performing this subtraction is an obvious modification that can be performed by one of ordinary skill in the art using the subtracting unit taught by Negrelli et al. in view of Strobel.

The applicant also argues that the references Negrelli et al. in view of Strobel in further view of Ohishi used in the 35 U.S.C. 103(a) rejection of claims 6 and 16 do not teach a calibration unit configured to calibrate the plurality of mask images and the plurality of contrast images by using vertically and horizontally arranged lines forming a lattice as a calibration image. The examiner maintains the rejection because Ohishi teaches calibration unit in column 11 lines 35-42 ("...the referencing projection image data is looked up to compute the grid points Q1 (grid-point information) at each of which wires intersect to each other. The 3D reconstructing processor 33 then corrects the grid points Q1 (refer to FIG. 5B) so as to be equal in intervals like the grid points Q2 (refer to FIG. 5A) (i.e., correction of the grid points)., and is also illustrated in Figure 2 as element 33"), where it is described that projection image data, which is acquired mask or contrast projection images as described in column 7 lines 58-65("After storing such projection data into the storages 22 and 23, the processing of subtractor 31 is activated so as to perform subtraction (DSA: Digital Subtraction Angiography) processing...the subtraction is carried out for every the same imaging angle, between an image (mask image) acquired before the injection of a contrast argent and an image (contrasted image) acquired after the injection

thereof."), is calibrated or corrected using vertical and horizontal lines that form a lattice as illustrated in Figures 5A and 5B.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Said Broome whose telephone number is (571)272-2931. The examiner can normally be reached on 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on (571)272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

S. Broome
4/20/06 SB

ULKA CHAUHAN
SUPERVISORY PATENT EXAMINER